HWce2
Universal MIDI console encoder
* user's guide *

1. What is this?

There are many virtual organ softwares available on market today. Amongst them, the most advanced, well-designed and popular is ***Hauptwerk*** virtual pipe organ (***www.hauptwerk.com***). It brings the real organ sounds and functionality closer to any musician providing that they are equipped with middle-class PC, MIDI controller (keyboards/pedal board or console) and good sound system.

Though the PC, virtual organ softwares and audio systems are widely available, there is still demand for an ***unit that would allow MIDI conversion of existing manuals, pedal boards or entire organ consoles*** that have been discarded after years of use but still have a nice vintage view and real organ look and feel, unlike the today's cheap plastic keyboards. Having these organ consoles MIDI-converted, it is easy to build MIDI-organ capable to produce realistic sound even in limited home space.

HWce was originally designed for using with ***Hauptwerk***.

HWce2 is the natural successor of our best-selling unit **HWce** and covers its entire functionality, adding better performance, wider capabilities within smaller size and lower cost.

HWce2 has 4 scan matrix inputs, each capable to scan and encode to MIDI up to 64 key contacts or general contacts. It has 8 additional switch/button inputs as well as 8 analog inputs where potentiometers can be wired directly for allowing Continuous control by faders, pedals etc.

Hence, **HWce2** has the capability of encoding up to 256+8=264 contacts and 8 potentiometers.

The most important capability of this unit though is its ***user-programmability***! Each of contacts can be programmed to send any combination of up to 32 MIDI bytes upon engaging and up to 32 MIDI bytes upon releasing. Each of potentiometers can be programmed to send up to 32 MIDI bytes upon position change where one or more of these bytes can carry the data about potentiometer's position (number between 0 and 127).

The support of user-programmability allows using **HWce2** for **controlling virtually any MIDI-controllable software or hardware**.

Last but not least: **HWce2** has MIDI Merge input capable of full merging, with 256-byte buffer, allowing other units to be easily cascaded to Hwce without additional MIDI Merge units.

2. How it works?

In **HWce2** internal program memory there is a table of MIDI bytes. For each of key inputs there are two entries/strings containing 32 MIDI-bytes: one string for On event and the other string for Off event. For each of potentiometers there is an 32-byte entry/string containing 32 MIDI bytes that are sent upon each potentiometer position change.

Hence, there is a table of totally 2*264 + 8 = 536 MIDI strings, each 32 bytes long.

Each of these strings can be reprogrammed by user for any MIDI content. The string can contain MIDI status bytes, MIDI Data bytes, System and Realtime MIDI messages, etc. It is entirely up to the user what MIDI string will be sent by triggering/changing each of **HWce2** inputs.

The programming is done by uploading the specific MIDI string to specific table entry via **HWce2** MIDI input. An special Windows-based application was designed for this purpose, called **hwce2prg.exe**. It is available for free download on our site (follow links on **HWce2** product page).

The **HWce2** can be programmed using other Windows or non-Windows applications, providing that they can send user-defined System Exclusive

messages and user-defined MIDI strings. The programming sequence and messages protocol and format are described in ***Appendix A*** of this document.

3. MIDI implementation

Appendix B shows the *factory-programmed* MIDI implementation of **Hwce2.**

This MIDI implementation can be used as it is and can be changed by user when/if necessary. In it each of scan points triggers NoteOn/NoteOff messages on separate channel per scan matrix. Channels 1,2,3 and 4 are covered. The note range is same for all scan matrices (MIDI notes 36 – 99). The additional switch/button inputs trigger Control Change messages (CC80-CC87) on MIDI channel 1. The continuous/potentiometer inputs trigger continuous controller CC7 (Volume) on MIDI channels 1-8.

4. Wiring diagrams

There are various ways of wiring **HWce2,** depending on contact system and wiring scheme chosen by user. The **Hwce2** can be wired directly to key contacts in a scheme called *scan matrix wiring*. No other devices are necessary in this scheme, except single serial diode added to each scan matrix contact being encoded. Usually diodes are soldered directly on one terminal of contact, so there is no need of additional PCB for them. The scan matrix/keyboard contacts should be organized in groups of 8 called Rows, 8 Rows that form scanmatrix. Up to 4 scan matrices can be connected this way. Unused scanmatrix headers/scan points should be left unconnected. Such architecture requires 16 wire ribbon cables between the scanmatrix headers of **HWce2** and the scan matrices themselves. The drawback of such wiring is that it requires a lot of internal wiring per scanmatrix, good soldering and wiring skills and quite a patience.

The additional switch/button and potentiometer control inputs should be connected to switches/buttons and potentiometers as shown on schematic. Each non-wired button/switch input will be read as being open contact (break). Each potentiometer input left unconnected will be read as potentiometer left in Max position. A button input connected to GND will be read as being closed contact (make). A potentiometer input that is not wired will be read as potentiometer left on Max position. In case switch/button control input is grounded, it will be read as closed contact. In case potentiometer input is grounded it will be read as potentiometers left in Min position.

The proper Control Change messages for each button and potentiometer will be transmitted once upon on initializing (starting up).

The other possible wiring schemes (as per bundles offered) are shown in ***Appendices C,D,E*** and ***F.***

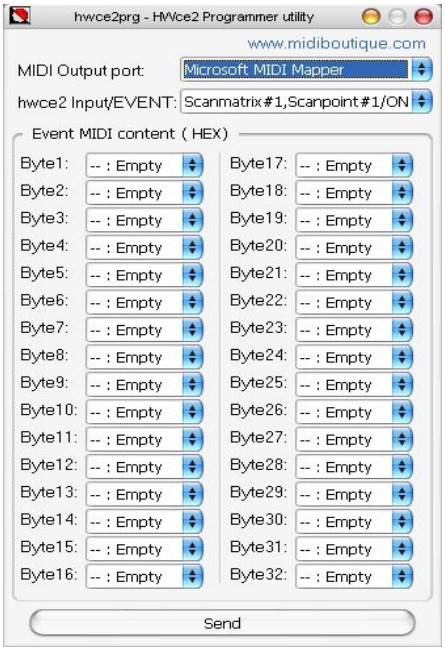
5.Technical specification.

Parameter	Value	Unit	Comment
Power supply voltage	9-12 AC/DC	V	Adapter or transformer
Power supply current	100	mA	
Number of contact inputs (scan points)	4x8x8 + 8 = 264	-	Normally open or normally closed type
Scan rate for contacts	400	S^{-1}	Each key contact is being scanned 400 times per second
Number of analog/potentiometer inputs	8		10 - 100 kOhm linear potentiometers (preferably 10kOhm)
Scan rate or potentiometers	50	S^{-1}	Each potentiometer is being scanned 50 times per second
MIDI messages	User-defined	-	Up to 32-byte MIDI user-defined string per event
MIDI channels	User-defined	-	Defined per MIDI event (single MIDI string can contain MIDI messages going on various MIDI channels
MIDI Merge	Yes	-	256 byte buffer
Size	12.7x6.4x2.5	cm	Approx. 5"x2.5"x1"
Weight	60	g	Approx. 2.1 oz

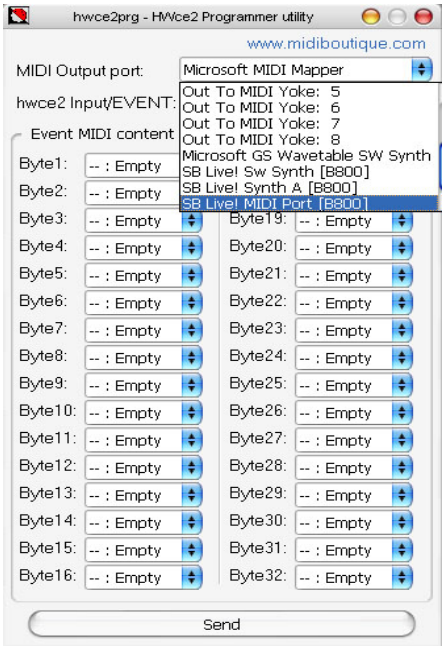
Appendix A. HWce2 – Programming

Step-by-step programming sequence

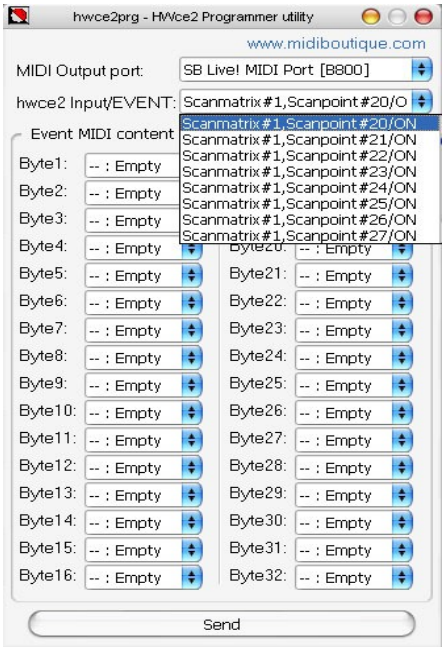
1. Download the ***HWce2prg.zip*** file from our site (www.midiboutique.com). The actual link can be found on **HWce2** product page.
2. Copy and unzip the downloaded file to dedicated folder.
3. Connect computer's MIDI output to **HWce2** MIDI input using standard MIDI cable.
4. Power up the **HWce2**.
5. Run the unzipped ***HWce2prg.exe*** utility.



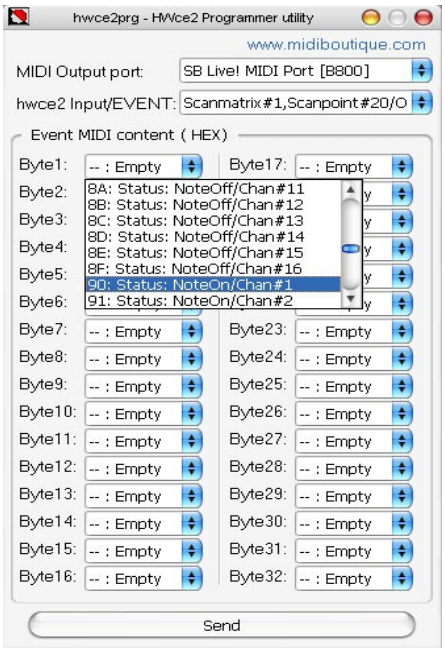
6. Select the proper MIDI output port from *'MIDI Output*' drop-down list.
   NOTES:
   Some systems may have more than one MIDI output, there could be hardware and virtual ports as well. Make sure you have selected the hardware port that is connected to ***HWce2*** *in previous steps.*


hwce2prg - HWce2 Programmer utility
www.midiboutique.com
MIDI Output port:
Microsoft MIDI Mapper
hwce2 Input/EVENT:
Out To MIDI Yoke: 5
Out To MIDI Yoke: 6
Out To MIDI Yoke: 7
Out To MIDI Yoke: 8
Microsoft GS Wavetable SW Synth
SB Live! Sw Synth [B800]
SB Live! Synth A [B800]
SB Live! MIDI Port [B800]
Event MIDI content
Byte1: -- : Empty
Byte2: -- : Empty
Byte3: -- : Empty
Byte4: -- : Empty
Byte5: -- : Empty
Byte6: -- : Empty
Byte7: -- : Empty
Byte8: -- : Empty
Byte9: -- : Empty
Byte10: -- : Empty
Byte11: -- : Empty
Byte12: -- : Empty
Byte13: -- : Empty
Byte14: -- : Empty
Byte15: -- : Empty
Byte16: -- : Empty
Byte19: -- : Empty
Byte20: -- : Empty
Byte21: -- : Empty
Byte22: -- : Empty
Byte23: -- : Empty
Byte24: -- : Empty
Byte25: -- : Empty
Byte26: -- : Empty
Byte27: -- : Empty
Byte28: -- : Empty
Byte29: -- : Empty
Byte30: -- : Empty
Byte31: -- : Empty
Byte32: -- : Empty
Send

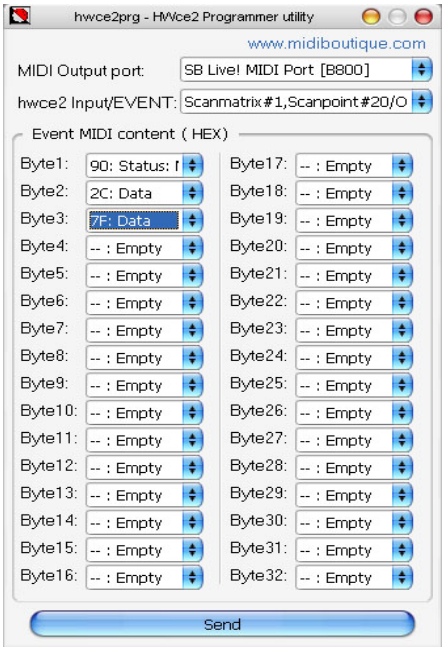
7. Select the event you want to program. All user programmable MIDI events are listed in '**HWce2** Input/EVENT' drop-down list. There are three groups of events: ON-event for contact inputs, OFF-event for contact inputs and CHANGE events for potentiometer inputs.



8. Choose desired event content byte-by-byte by selecting byte values.
   NOTES:
   For any event, each byte that has assigned '- - :Empty' value or HEX value of FF will be ignored and won't be producing MIDI output traffic.
   For potentiometer events each byte that has assigned HEX value of E6 will be replaced by potentiometer data in range 0-127 as read from potentiometer.
   Hence, System Reset MIDI message (HEX FF) cannot be programmed in any event and TUNE REQUEST MIDI message cannot be programmed in potentiometer events.



9. After the MIDI string has been configured, press once the 'Send' button at the bottom.



10. Repeat steps 6 .. 9 as many times as necessary for programming desired events.
11. The unit is programmed and can be used.

NOTES:
The programmed MIDI strings will be permanently kept in non-volatile (power-independent) memory and won't change until next programming.
*More than one **HWce2** unit can be chained together and will be programmed simultaneously as each **HWce2** would retransmit whatever MIDI traffic it gets.*

Programming protocol

The programming protocol includes three parts:

Header message.
This is *optional* 10-byte System exclusive message that only causes reset of program input queue (the 32-byte input buffer that receives the MIDI string to be programmed). During reset, all the 32 bytes of Program buffer are set to HEX value of FF. If the string to be programmed is 32 bytes long, the header message can be omitted as the input queue will be updated entirely . The format of this message is:

Header message - 10 bytes (all shown in HEX format)

```
F0 - SysEx start
00 - first ID
21 - sec. ID  (MGB)
7F - thd. ID  (MGB)
0A - Device ID (HWce2)
00 - Device sub-ID (message: Reset buffer)
xx - future use byte (set to 00)
xx - future use byte (set to 00)
xx - future use byte (set to 00)
F7 - SysEx end
```

The MIDI string itself.
It can be between 0 and 32 bytes long. In case of 0 bytes, the MIDI string for the programmed event is considered empty and this event won't be producing any MIDI output. This has the same effect as programming HEX FF value to all 32 bytes of this

string. This feature is suitable for programming switches that would transmit Program change messages upon contact make and nothing upon contact break.
If an MIDI string is longer than 32 bytes, only the last 32 bytes will take place. Any MIDI bytes of any order can be transmitted. The only two values that have special meaning are HEX FF (MIDI Reset) and HEX F6 (MIDI Tune Request). Refer to notes after the Step 8 of step-by-step programming sequence described above about these special considerations.

Footer message.
This is *obligatory* 10-byte System exclusive message that passes to **HWce2** the table entry number to be programmed, and invokes the memory-write routines to copy the input buffer content to proper table entry.

Footer message - 10 bytes (all shown in HEX format)

```
F0 - SysEx start
00 - first ID
21 - sec. ID  (MGB)
7F - thd. ID
0A - Device ID (HWce2)
01 - Device sub-ID (message ID = 01: Store buffer)
ll - Entry number, LSB (7-bit value 00..7F)
mm - Entry number, MSB (7-bit value 00..07)
xx - Future use byte (set to 00)
F7 - SysEx end
```

Appendix B. HWce2 – factory MIDI implementation

Scan matrix#1					
Input#	**Control type**	**MIDI message on make**	**MIDI message on break**	**MIDI channel**	**Comment**
1	momentary contact/switch	NoteOn #36	NoteOff #36	1	
2	momentary contact/switch	NoteOn #37	NoteOff #37	1	
3	momentary contact/switch	NoteOn #38	NoteOff #38	1	
4	momentary contact/switch	NoteOn #39	NoteOff #39	1	
5	momentary contact/switch	NoteOn #40	NoteOff #40	1	
6	momentary contact/switch	NoteOn #41	NoteOff #41	1	
7	momentary contact/switch	NoteOn #42	NoteOff #42	1	
8	momentary contact/switch	NoteOn #43	NoteOff #43	1	
9	momentary contact/switch	NoteOn #44	NoteOff #44	1	
10	momentary contact/switch	NoteOn #45	NoteOff #45	1	
11	momentary contact/switch	NoteOn #46	NoteOff #46	1	
12	momentary contact/switch	NoteOn #47	NoteOff #47	1	
13	momentary contact/switch	NoteOn #48	NoteOff #48	1	
14	momentary contact/switch	NoteOn #49	NoteOff #49	1	
15	momentary contact/switch	NoteOn #50	NoteOff #50	1	
16	momentary contact/switch	NoteOn #51	NoteOff #51	1	
17	momentary contact/switch	NoteOn #52	NoteOff #52	1	
18	momentary contact/switch	NoteOn #53	NoteOff #53	1	
19	momentary contact/switch	NoteOn #54	NoteOff #54	1	
20	momentary contact/switch	NoteOn #55	NoteOff #55	1	
21	momentary contact/switch	NoteOn #56	NoteOff #56	1	
22	momentary contact/switch	NoteOn #57	NoteOff #57	1	
23	momentary contact/switch	NoteOn #58	NoteOff #58	1	
24	momentary contact/switch	NoteOn #59	NoteOff #59	1	
25	momentary contact/switch	NoteOn #60	NoteOff #60	1	
26	momentary contact/switch	NoteOn #61	NoteOff #61	1	
27	momentary contact/switch	NoteOn #62	NoteOff #62	1	
28	momentary contact/switch	NoteOn #63	NoteOff #63	1	
29	momentary contact/switch	NoteOn #64	NoteOff #64	1	
30	momentary contact/switch	NoteOn #65	NoteOff #65	1	
31	momentary contact/switch	NoteOn #66	NoteOff #66	1	
32	momentary contact/switch	NoteOn #67	NoteOff #67	1	
33	momentary contact/switch	NoteOn #68	NoteOff #68	1	
34	momentary contact/switch	NoteOn #69	NoteOff #69	1	
35	momentary contact/switch	NoteOn #70	NoteOff #70	1	
36	momentary contact/switch	NoteOn #71	NoteOff #71	1	
37	momentary contact/switch	NoteOn #72	NoteOff #72	1	
38	momentary contact/switch	NoteOn #73	NoteOff #73	1	
39	momentary contact/switch	NoteOn #74	NoteOff #74	1	
40	momentary contact/switch	NoteOn #75	NoteOff #75	1	
41	momentary contact/switch	NoteOn #76	NoteOff #76	1	
42	momentary contact/switch	NoteOn #77	NoteOff #77	1	
43	momentary contact/switch	NoteOn #78	NoteOff #78	1	
44	momentary contact/switch	NoteOn #79	NoteOff #79	1	
45	momentary contact/switch	NoteOn #80	NoteOff #80	1	
46	momentary contact/switch	NoteOn #81	NoteOff #81	1	
47	momentary contact/switch	NoteOn #82	NoteOff #82	1	
48	momentary contact/switch	NoteOn #83	NoteOff #83	1	
49	momentary contact/switch	NoteOn #84	NoteOff #84	1	
50	momentary contact/switch	NoteOn #85	NoteOff #85	1	
51	momentary contact/switch	NoteOn #86	NoteOff #86	1	

52	momentary contact/switch	NoteOn #87	NoteOff #87	1	
53	momentary contact/switch	NoteOn #88	NoteOff #88	1	
54	momentary contact/switch	NoteOn #89	NoteOff #89	1	
55	momentary contact/switch	NoteOn #90	NoteOff #90	1	
56	momentary contact/switch	NoteOn #91	NoteOff #91	1	
57	momentary contact/switch	NoteOn #92	NoteOff #92	1	
58	momentary contact/switch	NoteOn #93	NoteOff #93	1	
59	momentary contact/switch	NoteOn #94	NoteOff #94	1	
60	momentary contact/switch	NoteOn #95	NoteOff #95	1	
61	momentary contact/switch	NoteOn #96	NoteOff #96	1	
62	momentary contact/switch	NoteOn #97	NoteOff #97	1	
63	momentary contact/switch	NoteOn #98	NoteOff #98	1	
64	momentary contact/switch	NoteOn #99	NoteOff #99	1	

Scan matrix#2

Input#	Control type	MIDI message on make	MIDI message on break	MIDI channel	Comment
1	momentary contact/switch	NoteOn #36	NoteOff #36	2	
2	momentary contact/switch	NoteOn #37	NoteOff #37	2	
3	momentary contact/switch	NoteOn #38	NoteOff #38	2	
4	momentary contact/switch	NoteOn #39	NoteOff #39	2	
5	momentary contact/switch	NoteOn #40	NoteOff #40	2	
6	momentary contact/switch	NoteOn #41	NoteOff #41	2	
7	momentary contact/switch	NoteOn #42	NoteOff #42	2	
8	momentary contact/switch	NoteOn #43	NoteOff #43	2	
9	momentary contact/switch	NoteOn #44	NoteOff #44	2	
10	momentary contact/switch	NoteOn #45	NoteOff #45	2	
11	momentary contact/switch	NoteOn #46	NoteOff #46	2	
12	momentary contact/switch	NoteOn #47	NoteOff #47	2	
13	momentary contact/switch	NoteOn #48	NoteOff #48	2	
14	momentary contact/switch	NoteOn #49	NoteOff #49	2	
15	momentary contact/switch	NoteOn #50	NoteOff #50	2	
16	momentary contact/switch	NoteOn #51	NoteOff #51	2	
17	momentary contact/switch	NoteOn #52	NoteOff #52	2	
18	momentary contact/switch	NoteOn #53	NoteOff #53	2	
19	momentary contact/switch	NoteOn #54	NoteOff #54	2	
20	momentary contact/switch	NoteOn #55	NoteOff #55	2	
21	momentary contact/switch	NoteOn #56	NoteOff #56	2	
22	momentary contact/switch	NoteOn #57	NoteOff #57	2	
23	momentary contact/switch	NoteOn #58	NoteOff #58	2	
24	momentary contact/switch	NoteOn #59	NoteOff #59	2	
25	momentary contact/switch	NoteOn #60	NoteOff #60	2	
26	momentary contact/switch	NoteOn #61	NoteOff #61	2	
27	momentary contact/switch	NoteOn #62	NoteOff #62	2	
28	momentary contact/switch	NoteOn #63	NoteOff #63	2	
29	momentary contact/switch	NoteOn #64	NoteOff #64	2	
30	momentary contact/switch	NoteOn #65	NoteOff #65	2	
31	momentary contact/switch	NoteOn #66	NoteOff #66	2	
32	momentary contact/switch	NoteOn #67	NoteOff #67	2	
33	momentary contact/switch	NoteOn #68	NoteOff #68	2	
34	momentary contact/switch	NoteOn #69	NoteOff #69	2	
35	momentary contact/switch	NoteOn #70	NoteOff #70	2	
36	momentary contact/switch	NoteOn #71	NoteOff #71	2	
37	momentary contact/switch	NoteOn #72	NoteOff #72	2	
38	momentary contact/switch	NoteOn #73	NoteOff #73	2	
39	momentary contact/switch	NoteOn #74	NoteOff #74	2	
40	momentary contact/switch	NoteOn #75	NoteOff #75	2	

41	momentary contact/switch	NoteOn #76	NoteOff #76	2	
42	momentary contact/switch	NoteOn #77	NoteOff #77	2	
43	momentary contact/switch	NoteOn #78	NoteOff #78	2	
44	momentary contact/switch	NoteOn #79	NoteOff #79	2	
45	momentary contact/switch	NoteOn #80	NoteOff #80	2	
46	momentary contact/switch	NoteOn #81	NoteOff #81	2	
47	momentary contact/switch	NoteOn #82	NoteOff #82	2	
48	momentary contact/switch	NoteOn #83	NoteOff #83	2	
49	momentary contact/switch	NoteOn #84	NoteOff #84	2	
50	momentary contact/switch	NoteOn #85	NoteOff #85	2	
51	momentary contact/switch	NoteOn #86	NoteOff #86	2	
52	momentary contact/switch	NoteOn #87	NoteOff #87	2	
53	momentary contact/switch	NoteOn #88	NoteOff #88	2	
54	momentary contact/switch	NoteOn #89	NoteOff #89	2	
55	momentary contact/switch	NoteOn #90	NoteOff #90	2	
56	momentary contact/switch	NoteOn #91	NoteOff #91	2	
57	momentary contact/switch	NoteOn #92	NoteOff #92	2	
58	momentary contact/switch	NoteOn #93	NoteOff #93	2	
59	momentary contact/switch	NoteOn #94	NoteOff #94	2	
60	momentary contact/switch	NoteOn #95	NoteOff #95	2	
61	momentary contact/switch	NoteOn #96	NoteOff #96	2	
62	momentary contact/switch	NoteOn #97	NoteOff #97	2	
63	momentary contact/switch	NoteOn #98	NoteOff #98	2	
64	momentary contact/switch	NoteOn #99	NoteOff #99	2	

Scan matrix#3

Input#	Control type	MIDI message on make	MIDI message on break	MIDI channel	Comment
1	momentary contact/switch	NoteOn #36	NoteOff #36	3	
2	momentary contact/switch	NoteOn #37	NoteOff #37	3	
3	momentary contact/switch	NoteOn #38	NoteOff #38	3	
4	momentary contact/switch	NoteOn #39	NoteOff #39	3	
5	momentary contact/switch	NoteOn #40	NoteOff #40	3	
6	momentary contact/switch	NoteOn #41	NoteOff #41	3	
7	momentary contact/switch	NoteOn #42	NoteOff #42	3	
8	momentary contact/switch	NoteOn #43	NoteOff #43	3	
9	momentary contact/switch	NoteOn #44	NoteOff #44	3	
10	momentary contact/switch	NoteOn #45	NoteOff #45	3	
11	momentary contact/switch	NoteOn #46	NoteOff #46	3	
12	momentary contact/switch	NoteOn #47	NoteOff #47	3	
13	momentary contact/switch	NoteOn #48	NoteOff #48	3	
14	momentary contact/switch	NoteOn #49	NoteOff #49	3	
15	momentary contact/switch	NoteOn #50	NoteOff #50	3	
16	momentary contact/switch	NoteOn #51	NoteOff #51	3	
17	momentary contact/switch	NoteOn #52	NoteOff #52	3	
18	momentary contact/switch	NoteOn #53	NoteOff #53	3	
19	momentary contact/switch	NoteOn #54	NoteOff #54	3	
20	momentary contact/switch	NoteOn #55	NoteOff #55	3	
21	momentary contact/switch	NoteOn #56	NoteOff #56	3	
22	momentary contact/switch	NoteOn #57	NoteOff #57	3	
23	momentary contact/switch	NoteOn #58	NoteOff #58	3	
24	momentary contact/switch	NoteOn #59	NoteOff #59	3	
25	momentary contact/switch	NoteOn #60	NoteOff #60	3	
26	momentary contact/switch	NoteOn #61	NoteOff #61	3	
27	momentary contact/switch	NoteOn #62	NoteOff #62	3	
28	momentary contact/switch	NoteOn #63	NoteOff #63	3	
29	momentary contact/switch	NoteOn #64	NoteOff #64	3	

30	momentary contact/switch	NoteOn #65	NoteOff #65	3	
31	momentary contact/switch	NoteOn #66	NoteOff #66	3	
32	momentary contact/switch	NoteOn #67	NoteOff #67	3	
33	momentary contact/switch	NoteOn #68	NoteOff #68	3	
34	momentary contact/switch	NoteOn #69	NoteOff #69	3	
35	momentary contact/switch	NoteOn #70	NoteOff #70	3	
36	momentary contact/switch	NoteOn #71	NoteOff #71	3	
37	momentary contact/switch	NoteOn #72	NoteOff #72	3	
38	momentary contact/switch	NoteOn #73	NoteOff #73	3	
39	momentary contact/switch	NoteOn #74	NoteOff #74	3	
40	momentary contact/switch	NoteOn #75	NoteOff #75	3	
41	momentary contact/switch	NoteOn #76	NoteOff #76	3	
42	momentary contact/switch	NoteOn #77	NoteOff #77	3	
43	momentary contact/switch	NoteOn #78	NoteOff #78	3	
44	momentary contact/switch	NoteOn #79	NoteOff #79	3	
45	momentary contact/switch	NoteOn #80	NoteOff #80	3	
46	momentary contact/switch	NoteOn #81	NoteOff #81	3	
47	momentary contact/switch	NoteOn #82	NoteOff #82	3	
48	momentary contact/switch	NoteOn #83	NoteOff #83	3	
49	momentary contact/switch	NoteOn #84	NoteOff #84	3	
50	momentary contact/switch	NoteOn #85	NoteOff #85	3	
51	momentary contact/switch	NoteOn #86	NoteOff #86	3	
52	momentary contact/switch	NoteOn #87	NoteOff #87	3	
53	momentary contact/switch	NoteOn #88	NoteOff #88	3	
54	momentary contact/switch	NoteOn #89	NoteOff #89	3	
55	momentary contact/switch	NoteOn #90	NoteOff #90	3	
56	momentary contact/switch	NoteOn #91	NoteOff #91	3	
57	momentary contact/switch	NoteOn #92	NoteOff #92	3	
58	momentary contact/switch	NoteOn #93	NoteOff #93	3	
59	momentary contact/switch	NoteOn #94	NoteOff #94	3	
60	momentary contact/switch	NoteOn #95	NoteOff #95	3	
61	momentary contact/switch	NoteOn #96	NoteOff #96	3	
62	momentary contact/switch	NoteOn #97	NoteOff #97	3	
63	momentary contact/switch	NoteOn #98	NoteOff #98	3	
64	momentary contact/switch	NoteOn #99	NoteOff #99	3	

Scan matrix#4

Input#	Control type	MIDI message on make	MIDI message on break	MIDI channel	Comment
1	momentary contact/switch	NoteOn #36	NoteOff #36	4	
2	momentary contact/switch	NoteOn #37	NoteOff #37	4	
3	momentary contact/switch	NoteOn #38	NoteOff #38	4	
4	momentary contact/switch	NoteOn #39	NoteOff #39	4	
5	momentary contact/switch	NoteOn #40	NoteOff #40	4	
6	momentary contact/switch	NoteOn #41	NoteOff #41	4	
7	momentary contact/switch	NoteOn #42	NoteOff #42	4	
8	momentary contact/switch	NoteOn #43	NoteOff #43	4	
9	momentary contact/switch	NoteOn #44	NoteOff #44	4	
10	momentary contact/switch	NoteOn #45	NoteOff #45	4	
11	momentary contact/switch	NoteOn #46	NoteOff #46	4	
12	momentary contact/switch	NoteOn #47	NoteOff #47	4	
13	momentary contact/switch	NoteOn #48	NoteOff #48	4	
14	momentary contact/switch	NoteOn #49	NoteOff #49	4	
15	momentary contact/switch	NoteOn #50	NoteOff #50	4	
16	momentary contact/switch	NoteOn #51	NoteOff #51	4	
17	momentary contact/switch	NoteOn #52	NoteOff #52	4	
18	momentary contact/switch	NoteOn #53	NoteOff #53	4	

19	momentary contact/switch	NoteOn #54	NoteOff #54	4	
20	momentary contact/switch	NoteOn #55	NoteOff #55	4	
21	momentary contact/switch	NoteOn #56	NoteOff #56	4	
22	momentary contact/switch	NoteOn #57	NoteOff #57	4	
23	momentary contact/switch	NoteOn #58	NoteOff #58	4	
24	momentary contact/switch	NoteOn #59	NoteOff #59	4	
25	momentary contact/switch	NoteOn #60	NoteOff #60	4	
26	momentary contact/switch	NoteOn #61	NoteOff #61	4	
27	momentary contact/switch	NoteOn #62	NoteOff #62	4	
28	momentary contact/switch	NoteOn #63	NoteOff #63	4	
29	momentary contact/switch	NoteOn #64	NoteOff #64	4	
30	momentary contact/switch	NoteOn #65	NoteOff #65	4	
31	momentary contact/switch	NoteOn #66	NoteOff #66	4	
32	momentary contact/switch	NoteOn #67	NoteOff #67	4	
33	momentary contact/switch	NoteOn #68	NoteOff #68	4	
34	momentary contact/switch	NoteOn #69	NoteOff #69	4	
35	momentary contact/switch	NoteOn #70	NoteOff #70	4	
36	momentary contact/switch	NoteOn #71	NoteOff #71	4	
37	momentary contact/switch	NoteOn #72	NoteOff #72	4	
38	momentary contact/switch	NoteOn #73	NoteOff #73	4	
39	momentary contact/switch	NoteOn #74	NoteOff #74	4	
40	momentary contact/switch	NoteOn #75	NoteOff #75	4	
41	momentary contact/switch	NoteOn #76	NoteOff #76	4	
42	momentary contact/switch	NoteOn #77	NoteOff #77	4	
43	momentary contact/switch	NoteOn #78	NoteOff #78	4	
44	momentary contact/switch	NoteOn #79	NoteOff #79	4	
45	momentary contact/switch	NoteOn #80	NoteOff #80	4	
46	momentary contact/switch	NoteOn #81	NoteOff #81	4	
47	momentary contact/switch	NoteOn #82	NoteOff #82	4	
48	momentary contact/switch	NoteOn #83	NoteOff #83	4	
49	momentary contact/switch	NoteOn #84	NoteOff #84	4	
50	momentary contact/switch	NoteOn #85	NoteOff #85	4	
51	momentary contact/switch	NoteOn #86	NoteOff #86	4	
52	momentary contact/switch	NoteOn #87	NoteOff #87	4	
53	momentary contact/switch	NoteOn #88	NoteOff #88	4	
54	momentary contact/switch	NoteOn #89	NoteOff #89	4	
55	momentary contact/switch	NoteOn #90	NoteOff #90	4	
56	momentary contact/switch	NoteOn #91	NoteOff #91	4	
57	momentary contact/switch	NoteOn #92	NoteOff #92	4	
58	momentary contact/switch	NoteOn #93	NoteOff #93	4	
59	momentary contact/switch	NoteOn #94	NoteOff #94	4	
60	momentary contact/switch	NoteOn #95	NoteOff #95	4	
61	momentary contact/switch	NoteOn #96	NoteOff #96	4	
62	momentary contact/switch	NoteOn #97	NoteOff #97	4	
63	momentary contact/switch	NoteOn #98	NoteOff #98	4	
64	momentary contact/switch	NoteOn #99	NoteOff #99	4	

Buttons

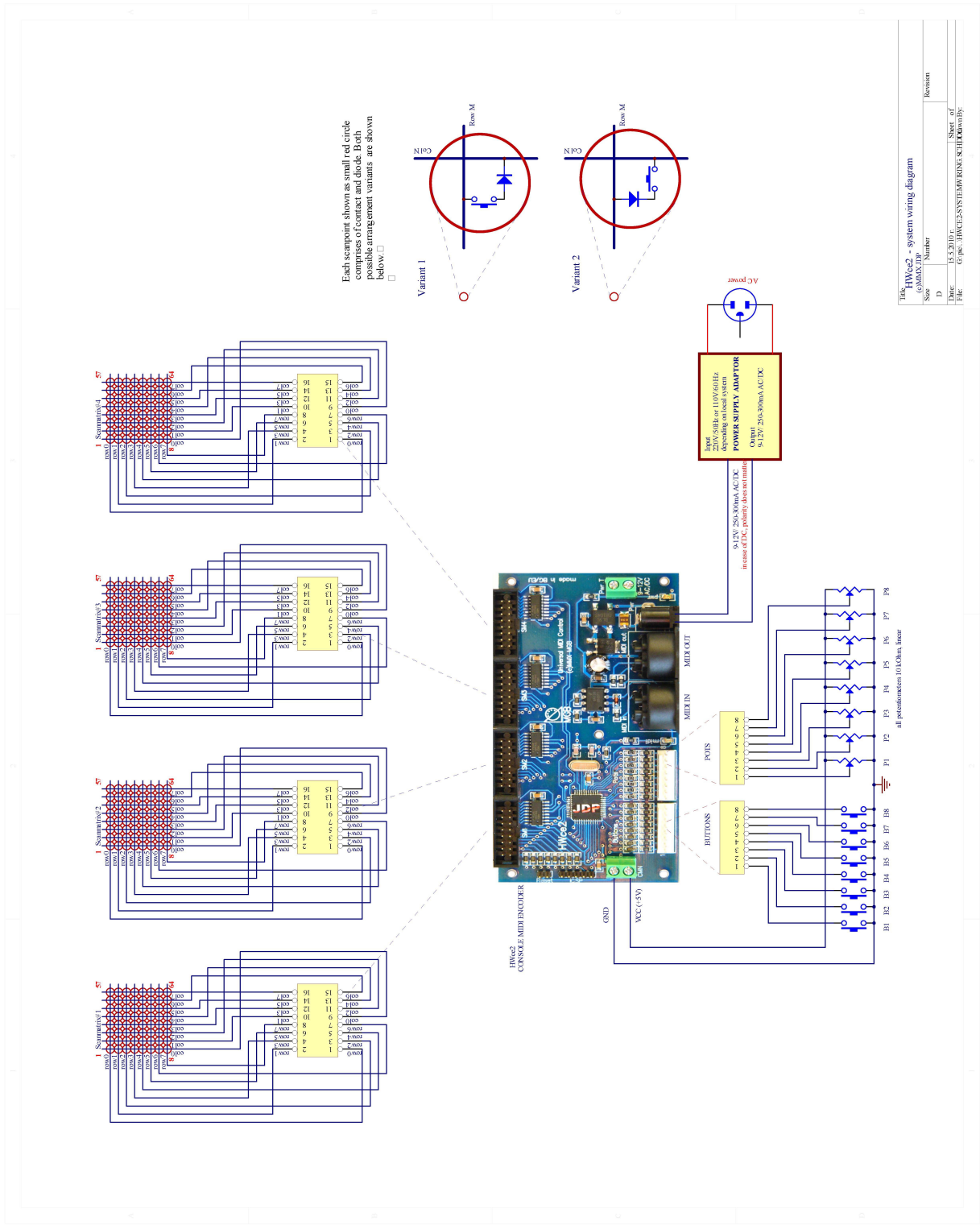
Pin#	Control type	MIDI message on change		MIDI channel	Comment
1	contact On/Off	CC#80 On	CC#80 Off	1	
2	contact On/Off	CC#81 On	CC#81 Off	1	
3	contact On/Off	CC#82 On	CC#82 Off	1	
4	contact On/Off	CC#83 On	CC#83 Off	1	
5	contact On/Off	CC#84 On	CC#84 Off	1	
6	contact On/Off	CC#85 On	CC#85 Off	1	

7	contact On/Off	CC#86 On	CC#86 Off	1	
8	momentary contact	CC#87 On/Off	CC#87 Off	1	

Potentiometers

Pin#	Control type	MIDI message on change	MIDI channel	Comment
1	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	1	
2	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	2	
3	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	3	
4	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	4	
5	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	5	
6	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	6	
7	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	7	
8	potentiometer or control voltage 0 .. +5V	CC7 (Volume)	8	

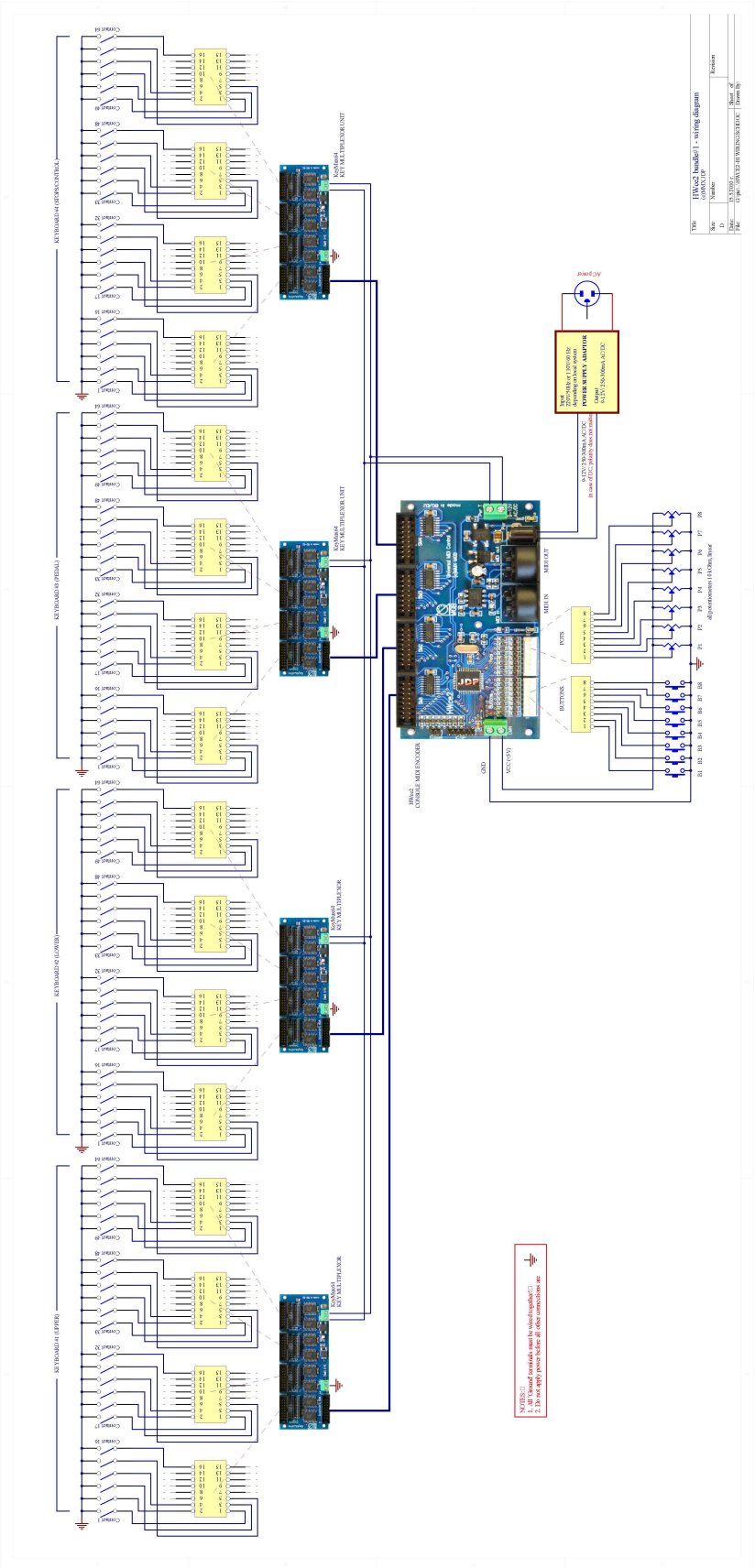
Appendix C. Wiring diagram for Scan matrix wiring



NOTE:

More detailed copy of this diagram is available on our site in **.pdf** format!

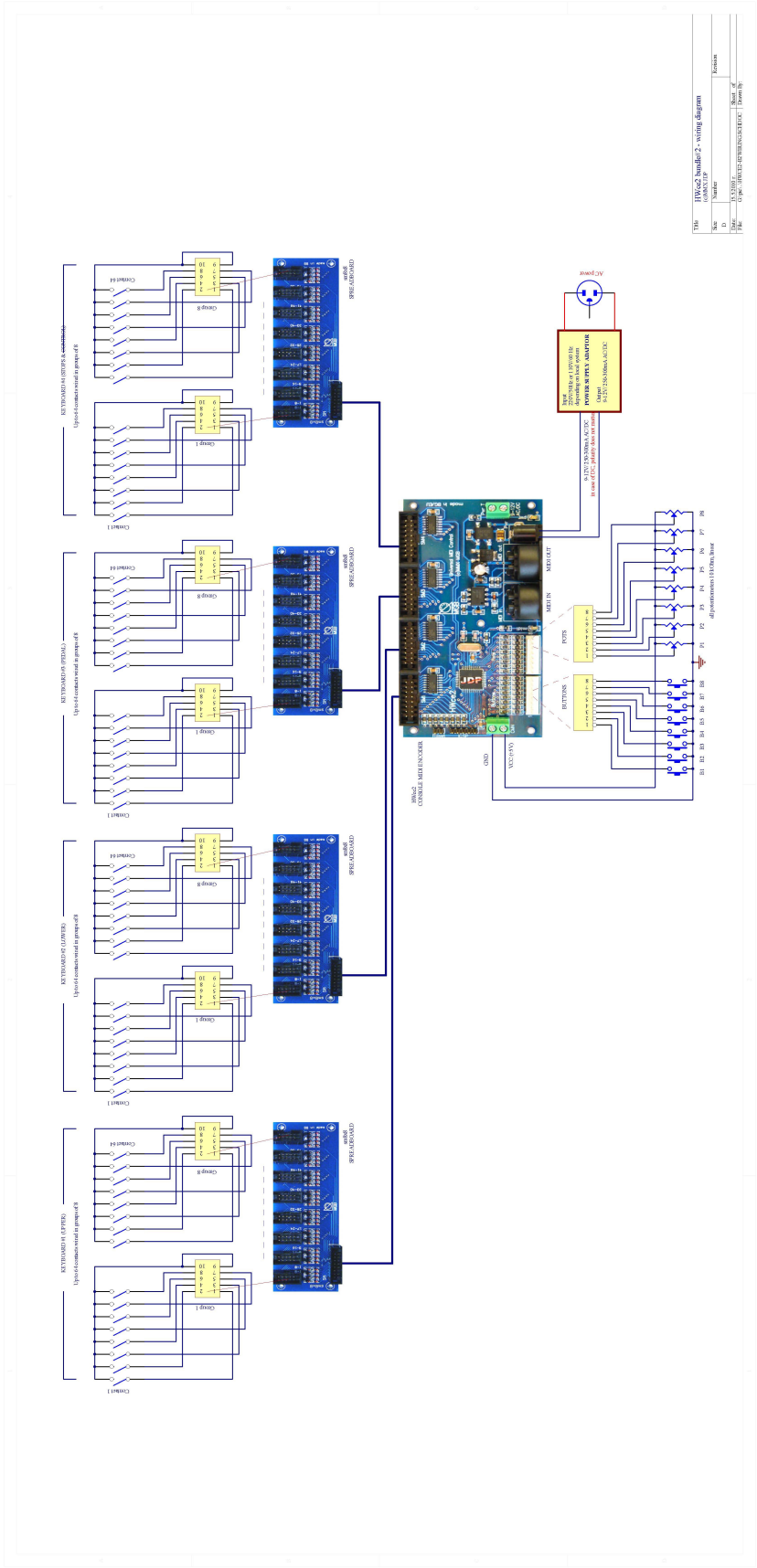
Appendix D. Wiring diagram for Hwce2-bundle#1



NOTE:

More detailed copy of this diagram is available on our site in **.pdf** format!

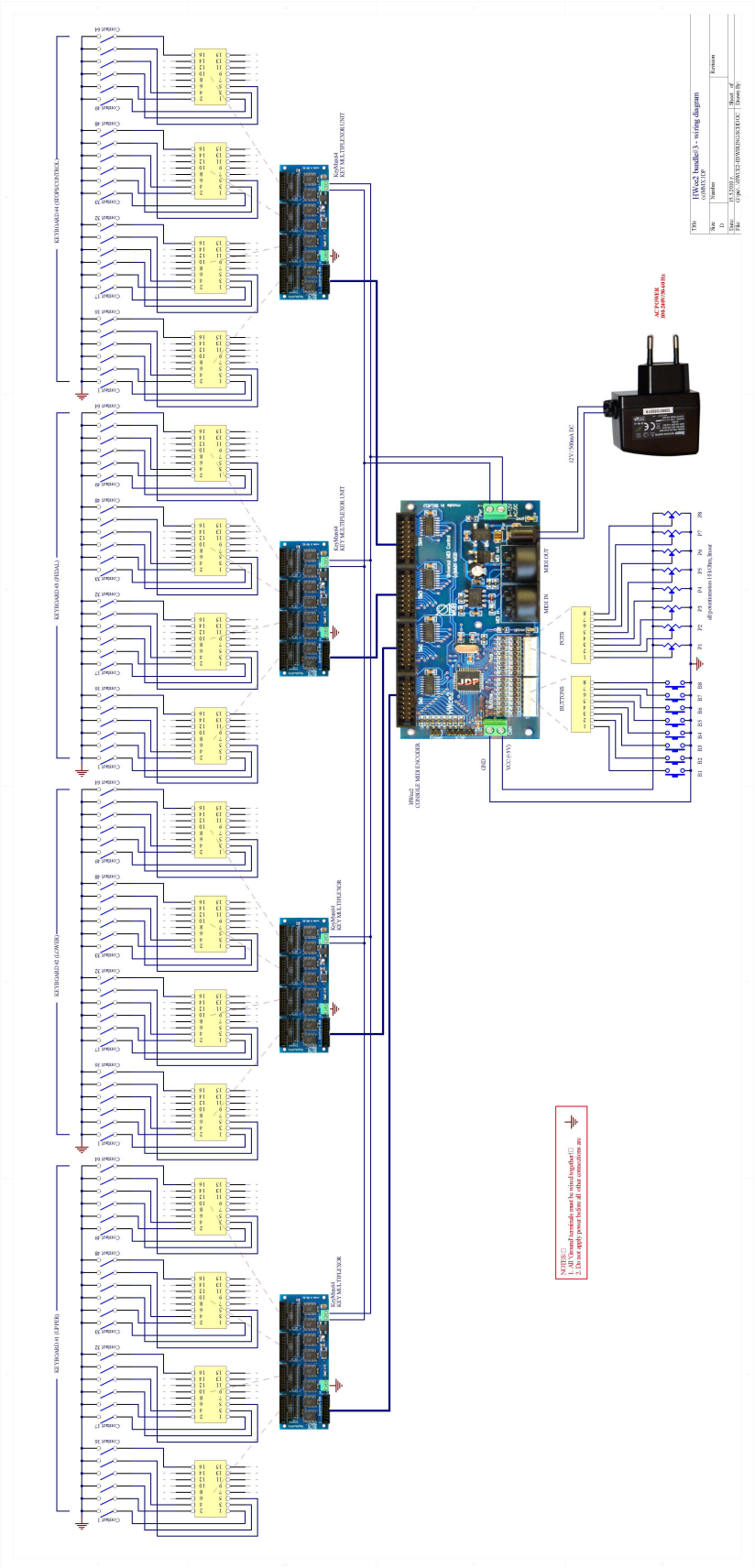
Appendix E. Wiring diagram for Hwce2-bundle#2



NOTE:

More detailed copy of this diagram is available on our site in **.pdf** format!

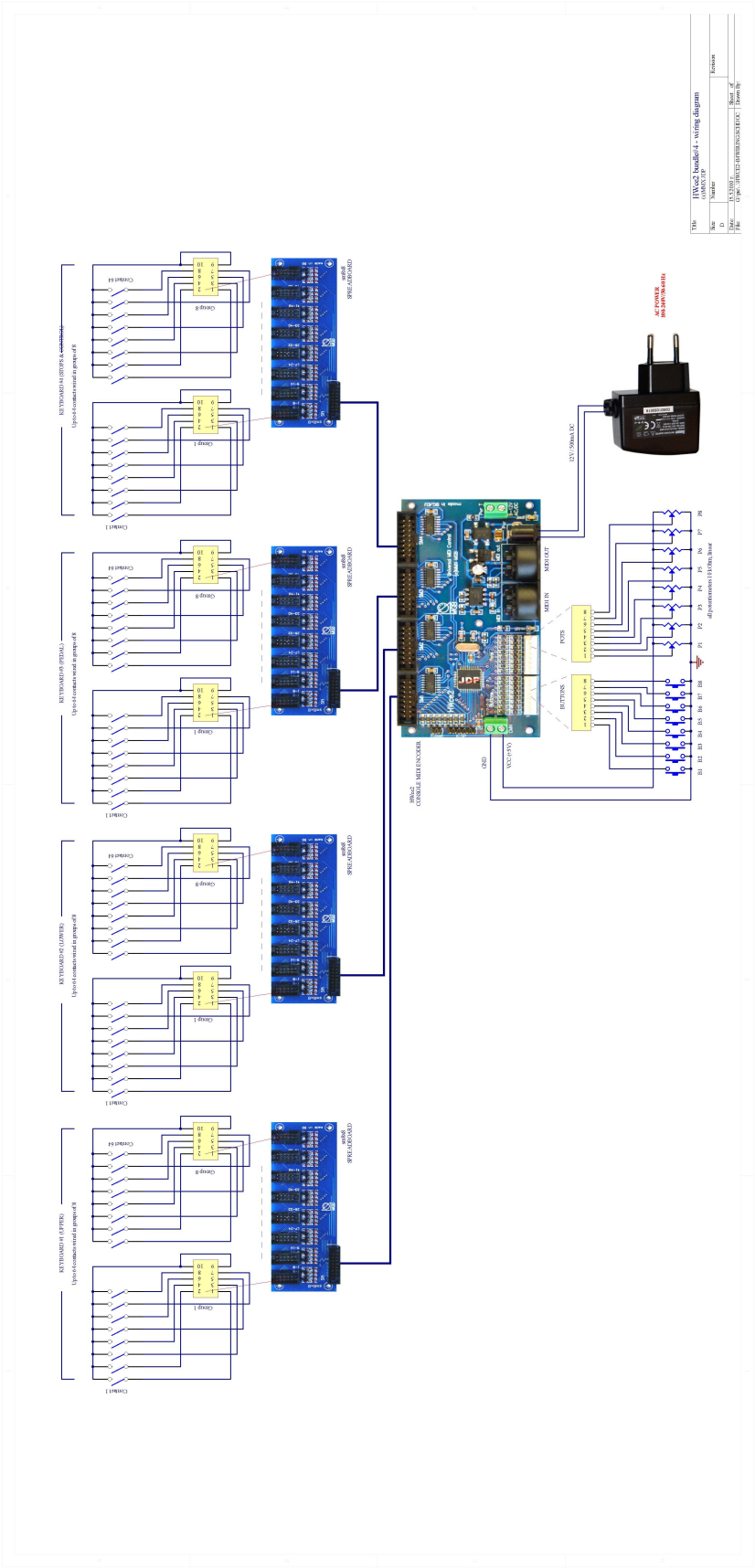
Appendix F. Wiring diagram for Hwce2-bundle#3



NOTE:

More detailed copy of this diagram is available on our site in **.pdf** format!

Appendix G. Wiring diagram for Hwce2-bundle#4



NOTE:

More detailed copy of this diagram is available on our site in **.pdf** format!